**SWIMMER'S SHOULDER**

**What is swimmer's shoulder?**

**Swimmer's shoulder is a general term used to describe an overuse shoulder injury occurring in swimmers.It represents a chronic irritation of the shoulder soft tissues (tendons, muscles, ligaments). This is also known as impingement syndrome. As an example: during a 25 yard freestyle swim, the right arm will typically perform 8 strokes (pull and recovery). In a typical workout of 4,000 yards the right arm will rotate 1,280 times. As you can see, if you have a small biomechanical problem, by the end of workout it will be worse.**

**What are some of the symptoms?**

**The symptoms will vary with the cause. However, there are some general trends. Usually the pain is the worst in backstroke, and least during breaststroke (except perhaps, where the biceps tendon is the primary culprit). Pain may occur at any phase of freestyle, and, depending on when it occurs, the diagnosis will be different (i.e. if the pain is worse during the recovery phase, think of rotator cuff involvement, whereas if the pain is worse during the initial pull, the biceps tendon may be more involved). Sleeping on the involved side aggravates the pain. When the problem is fairly advanced, the swimmer will also experience shoulder pain when not swimming, and the shoulder becomes progressively more tender to the touch.**

**Swimmer's shoulder is not an exact diagnosis. To obtain an accurate diagnosis (which muscles and tendons are involved) you should seek professional help from a sports medicine specialist (chiropractor, orthopedic surgeon). The examiner should take a detailed history and should understand the mechanics of swimming (see below). The examination should at least include an evaluation (for pain and weakness) of all your shoulder movements with and without resistance. X-rays are usually not necessary.**

**What causes swimmer's shoulder?**

**The causes will vary according to the specific problem. If your problem is the most common type of impingement syndrome, then it is usually related to a muscle imbalance.**

**The large internal rotators (pecs, lats) are used in the pull phase of freestyle, whereas the smaller, weaker external rotators (e.g. the rotator cuff muscles) are used in the recovery phase. Your problem may be with either group, although more commonly the problem is with the weak external rotators.**

**Some of the problems which may develop and cause impingement syndrome are:**

** insufficient body roll (should be 40¡-60¡) in crawl. This is even more important in backstroke, where insufficient body roll causes excessive tugging on the tendons.**

** over-developed pectoral muscles and under-developed rhomboids, middle and upper trapezeii, levator scapulae, upper lats (leads to an instability of shoulder).**

** weak rotator cuff muscles. These are the dynamic stabilizers of the shoulders.**

** excessive internal rotation during "catch": middle finger should enter water first, not thumb and index finger.**

** excessive adduction on the pull-through phase (your hand should not cross the midline).**

** dropped elbows occur if the internal rotators and adductors (pecs, lats) are not strong enough.**

** over-training with insufficient recovery time. This is especially true for those of you doing a rigorous weight-training program as well as swimming, without allowing your body enough time to recover. Over-training also occurs when one tries to make up for months of sloth in two weeks time (or years in 6 months)!**

** cantilevering on the arm opposite the breathing side. This is seen especially in one-sided breathing. If the elbow is not "cocked" at the beginning of the catch phase, a cantilevering occurs at the shoulder which aggravates or accelerates an impingement syndrome.**

**How do I treat swimmer's shoulder?**

**I can not emphasize enough that a proper diagnosis (identifying the involved muscles/tendons, and stage/severity of the problem) will lead to the most appropriate treatment. A good treatment plan includes:**

** reducing the inflammation and apply ice to the shoulder for 20 minutes after training (if training is appropriate). Use anti-inflammatories for the first few days. Chronic use of anti-inflammatories can affect the stomach, kidneys, and liver. It is not recommended to cover up the pain with drugs and swim anyway.**

** rest and depending on how severe the involvement, this may mean total rest (no swimming), or decreasing yardage while avoiding backstroke and butterfly, or kicking only with arms at one's side. It is wise to wait at least a couple of painfree days before resuming swim training.**

** passive care by a professional and may include ultrasound, interferential current, cross friction massage to the tendons, triggerpoint work (if triggerpoints were found in the diagnosis), post-isometric relaxation of the involved muscles, adjustments of the shoulder and/or neck.**

** rehabilitation exercises strengthen the weak muscles (usually the external rotators of the shoulders). These are not exercises commonly done at the gym, but exercises with minimal weights (3-5 lb.) done in a very specific, controlled manner. See handout for these exercises. If you have ever had shoulder problems, it is wise to do these exercises at least several times per week. Generally it is said that for every day a swimmer swims on a bad shoulder, one day of rehab time is required.**

** modify training : I could write a whole article alone on why hand paddles are bad for your shoulders... On the other hand, Zoomers or other fins, elevate your body in the water, so they may help if your shoulder starts giving you a small problem in workout. Have the coach check your body position (for roll), and arm position. If no coach is available, have a friend video tape your swimming. The tape is often quite revealing. Best of all: have a coach video tape your swimming and go over the stroke mechanics with you.**

**Shoulder pain in swimmers**

“Swimmer’s Shoulder” is a term that is used broadly to describe pain in and around the shoulder in association with swimming activities. The pain in “Swimmer’s Shoulder” is typically described as being anterior and is often in the region of the biceps tendon.  Contributing factors for the development of swimmer’s shoulder include:

1) Inadequate strength and endurance of the muscles around the shoulder, scapula, back, pelvis, and abdomen
2)Glenohumeral (shoulder joint) laxity or looseness
3) Poor stroke mechanics such as a dropped elbow and a lateral hand entry that may lead to impingement.
4) Muscle imbalances and inflexibility – specifically of the pectoral (chest) muscles and the posterior rotator cuff.

**Etiology or Cause of Swimmer’s Shoulder**

It is felt that there are three main causes for the shoulder pain.

1) The first factor in the development of swimmer’s shoulder is **overuse** leading to subsequent fatigue of the muscles around the shoulder, scapula, and upper back. Shoulder function is highly dependent on the coordinated function of many muscle groups. These include the muscles around the shoulder, those that control the scapula, muscles in the upper and lower back, as well as abdominal and pelvic muscles. The shoulder does not act in isolation during swimming. Muscles of the back, trunk and even legs are used to help stabilize the body and to assist in the pulling movement. Since the shoulder is an inherently unstable joint, muscle forces are critical for maintaining stability, proper motion, and painless function. The repetitive overhead activity of the swimming stroke can result in fatigue of these muscles.

2) The second factor in the etiology of swimmer’s shoulder relates to the **biomechanics of the swimming stroke**. Impingement of the supraspinatus or rotator cuff tendon can occur in various positions during the swimming stroke. Such impingement may be subacromial (the bursal surface of the rotator cuff against the anteroinferior acromion) or intra-articular (the articular surface of the rotator cuff and/or biceps tendon impinging on the anterosuperior glenoid and labrum). Glenohumeral laxity also causes secondary impingment during overhead activities.

3) The third factor is **laxity**. Many swimmers have an element of shoulder laxity or “looseness”. In fact, a certain degree of laxity is likely advantageous. There is a fine line between laxity (normal, physiologic) and instability or “too loose” (pathologic). Normal laxity may increase over time and eventually become pathologic. Shoulder stability is controlled by static (glenohumeral ligaments) and dynamic (rotator cuff muscles) factors. Loss of the static component (glenohumeral capsular laxity) requires a greater contribution from the rotator cuff, which can result in muscle overload and eventual muscle fatigue, as described above. The challenge for the medical practitioner is to distinguish between normal laxity and abnormal instability.



**Stroke Mechanics**

Subtle stroke alterations may be seen in the swimmer with a painful shoulder. These include:

- a dropped elbow (this position avoids internal rotation),
- a wider hand entry (avoids impingement due to forward flexion)
- early hand exit during pull-through (avoids hyperextension position)
- excessive body roll (allows less hyperextension).

Such stroke alterations may be causing shoulder pain, or alternatively, may be compensatory changes to relieve and/or avoid painful positions.

Based on these findings, stroke corrections can be suggested. For example, the coach/physician may suggest that the arm be held in less internal rotation during recovery, hand entry may be made more lateral to the midline at the entry phase, or body roll may be increased to the side of the painful shoulder during the recovery phase. However, it must be emphasized that stroke alterations should only be suggested in conjunction with careful discussion with the coach. The physician/trainer should not make technique suggestions without careful analysis of the individual swimmer’s stroke.

Treatment Considerations

The following table summarizes the initial treatment plan for the athlete complaining of shoulder pain:

- avoid strokes & positions that cause pain (butterfly/freestyle)
- ice the shoulder daily
- warm-up slowly prior to training
- modification of distance and frequency of training
- stop using paddles and avoid pulling sets
- kicking drills may be performs – avoid the impingement position
- use of fins to assist in maintaining good body position
- use of pull buoy to decrease drag
- avoid dry land upper extremity weight training
- correction of stroke biomechanical errors

After a period of rest, the athlete may gradually try to resume training. If there is recurrent pain upon resumption of more swimming activities, then the athlete should consider staying out of the water entirely for three days time. Use of non-steroidal anti-inflammatory medication may be considered. After this three-day period of rest, the athlete is reassessed, and if clear, he/she can once again resume a normal training regimen. If the shoulder pain rapidly recurs, then the team sports medicine physician should evaluate the athlete. The physician will perform a thorough physical examination and radiological evaluation to rule out any other shoulder pathologies, and to ascertain the severity of the problem. It is important to note that other bone or soft tissue lesions, although uncommon, can present in the athlete as sports-related pain.

Other factors that should prompt the coach or athlete to seek evaluation by the team physician include:

- pain that persists outside of swimming
- pain that persists at night
- pain that is present during everyday activities and while at school
- if the athlete feels that the shoulder “slips” or “feels loose’
- if there has been distinct trauma (a fall, etc.)
- if the athlete reports a new and painful click inside the joint
- if there has been recurrent periods of missed training due to shoulder pain over several seasons.

Treatment Pearls:

- avoid the stroke allowing rest of the tendon
- use of ice
- training modifications
- avoid use of paddles, pulling sets & dry land training
- correction of stroke mechanics
- consult the team sports medicine physician for assessment & treatment

**Prevention and Rehabilitation**

The principles of prevention and rehabilitation are the same. It is essential that a comprehensive program be devised for the athlete to develop muscular:

- strength
- endurance
- balance
- flexibility of the muscles

These exercises must address the three important anatomical areas:

1) the rotator cuff
2) the muscles that stabilize the scapula
3) the muscles of the low back, abdomen, and pelvis that make up the “core” of the body.

Although a comprehensive program for the shoulder and periscapular muscles is required, emphasis should be placed on endurance training/strengthening for the serratus anterior, rhomboids, lower trapezius, and subscapularis.

Gentle stretching of the rotator cuff and periscapular muscles is reasonable, but aggressive stretching may be deleterious. In particular, swimmers should generally avoid positions that stretch the anterior capsule as such stretches can exacerbate shoulder laxity. Gentle stretching of the pectoralis major muscle and posterior capsule may be required.

It is important to design an individualized program for the athlete’s specific needs. Each individual swimmer should be assessed to determine that individual’s strength, endurance, and/or flexibility deficits. This will allow precise, effective preventative and rehabilitation prescription. Rehabilitation/strengthening exercises should be performed after swimming training or several hours before practice. These exercises should not be performed right before swimming training as this may fatigue these muscles before swimming.

Rehabilitation Pearl:

Designing an individualized rehabilitation program for the athlete taking into consideration their specific needs is essential for successful rehabilitation.

**Future Study**

There is great need for further study of the swimmer’s shoulder. Our understanding of shoulder pain will be aided by identification of the relationship between shoulder pain and physical characteristics such as:

- posture
- glenohumeral laxity
- scapular kinematics
- sternoclavicular joint
- ribcage kinematics

We also need to explore the relationship of shoulder pain to pathology in other areas. For example, we need to define the relationship between neck, back and shoulder injury, and the role of sternoclavicular joint mobility and ribcage mechanics in swimmers with and without shoulder pain.It is also important to define the exact stroke mechanics that may lead to impingement and pain. This will aid in identification of the anatomic source of pain. This information can lead to the development of an effective preventative training program.

Since muscle overuse and resultant fatigue is associated with shoulder pain, there is a need to develop objective measures of muscle fatigue immediately after intense swimming.

**Summary**

In summary, it is evident that the health of the swimmer’s shoulder is an integral part of the aquatic athlete’s success. There are many factors involved in the development of this disorder. The potential causes, including the various stroke mechanics have been reviewed. In addition, identifying features have been discussed as well as treatment regimens. Areas requiring further scientific research have been discussed. As the body of scientific research improves, so will our understanding of the complex swimmer’s shoulder. Subsequent to this knowledge, our treatment regimens and preventative protocols will become more effective thereby allowing our athletes to compete to their fullest potential.

*\*****Dr. Scott Rodeo*** *works extensively with USA Swimming. He holds the following positions:
- Chief, Sports Medicine and Shoulder Service, Hospital for Special Surgery
- Associate Professor of Orthopaedic Surgery, Weill Medical College of Cornell University
- Associate Attending Orthopaedic Surgeon, Hospital for Special Surgery, New York City
- Associate Attending Surgeon (Orthopaedic Surgery), The New York-Presbyterian Hospital, New York City
- Assistant Scientist, Department of Research, Hospital for Special Surgery
- Associate Team Physician, New York Giants Football*

**Ask the Doc**

*I am a water polo player and I have just been diagnosed with swimmer’s shoulder. My doctor says that I shouldn’t be swimming. How will I stay in shape?*

It is important while you are rehabilitating your shoulder that you maintain your cardiovascular fitness and strength. You can cross train with running or cycling. In addition if you want to be in the water, you can do laps of kicking – remember to keep your arms by your side as your shoulder should not be kept elevated over your head for extended periods of time. Shooting is also not a good idea as this requires your arm to be extended above the shoulder. You can take this opportunity to work on your eggbeater skills.